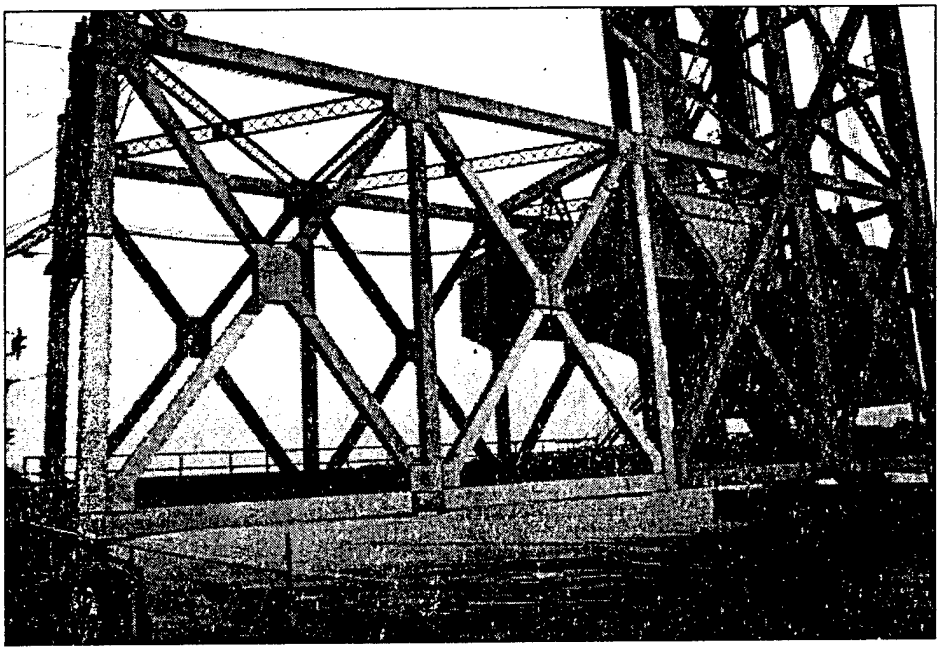
US Army Corps
of Engineers
Construction Engineering
Research Laboratory

CERL Special Report 99/87
November 1999

Cape Cod Railroad Bridge Coating Field Test Results

Alfred D. Beitelman

This report documents observations on the performance of six representative coating systems applied to a steel railroad bridge in 1994 as part of an Army Corps of Engineers field study. The objective of the study was to compare the performance of industry-accepted coating systems as applied to steel surfaces cleaned and prepared according to four different industry standards. The coatings were applied under contract by a local sandblasting and painting company working under typical field conditions.



Two field inspections of the coatings were conducted — once after 1 year of service and again after 5 years of service.

This report provides details on surface preparation, coating application, and field performance, including photographs of the test structure and manufacturers' literature on the six coatings tested.

US Army Corps
of Engineers
Construction Engineering
Research Laboratory

CERL Special Report 99/87
November 1999

Cape Cod Railroad Bridge Coating Field Test Results

Alfred D. Beitelman

This report documents observations on the performance of six representative coating systems applied to a steel railroad bridge in 1994 as part of an Army Corps of Engineers field study. The objective of the study was to compare the performance of industry-accepted coating systems as applied to steel surfaces cleaned and prepared according to four different industry standards. The coatings were applied under contract by a local sandblasting and painting company working under typical field conditions.

Two field inspections of the coatings were conducted — once after 1 year of service and again after 5 years of service.

This report provides details on surface preparation, coating application, and field performance, including photographs of the test structure and manufacturers' literature on the six coatings tested.

Foreword

This study was conducted for Headquarters, U.S. Army Corps of Engineers (HQUSACE) under Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program Work Unit 32666, "Maintenance and Removal of Lead-Pigmented Paints From Hydraulic Structures." The technical monitor was Andy Wu, CECW-EE.

The work was performed by the Materials and Structures Branch (CF-M) of the Facilities Division (CF), Construction Engineering Research Laboratory (CERL). The CERL Principal Investigator was Alfred D. Beitelman. A portion of this work was performed by USACE New England Division. Dr. Ilker R. Adiguzel is Chief, CEERD-CF-M, and L. Michael Golish is Chief, CEERD-CF. The technical editor was Gordon L. Cohen, Information Technology Laboratory – CERL.

The Director of CERL is Dr. Michael J. O'Connor.

Contents

List of Figures and Tables

Figures

Tables

1 Introduction

Background

On 22 July 1999 final observations were made on a field test of various types of coatings applied in 1994 to parts of a steel railroad bridge spanning the Cape Cod Canal near Buzzards Bay, MA. The coatings were applied under contract by a local sandblasting and painting company working under typical field conditions. Each test coating was applied to several areas of structural steel that had been cleaned to various grades according to industry standards.

Objective

The objective of this work was to test a number of coating systems as they would be applied in the field to a steel structure under a typical contract. The objective of this report is to document the performance of the subject coatings after 5 years of exposure in the field.

Approach

Six coatings were selected as representative of several generic types of products. Some of the proprietary coatings were selected because of good performance in a Steel Structures Painting Council APEC program. (There was no final report on the APEC program.) The coatings tested in this study were the following:

1. Amerlock 400 AL manufactured by Ameron Corporation, Protective Coatings Division, Brea CA. This product was selected as being typical of the numerous high solids epoxy coatings available in the market. It has a high solids content (88% by volume) which should have resulted in low shrinkage. This was deemed an important factor in the selection of a coating for application over an existing system witch might have marginal adhesion.

2. Kolorane 9500 manufactured by Keeler & Long, Watertown, CT. This product was selected as being typical of the numerous moisture cure aluminum coatings

available in the market. These products are known for their exceptional adhesion to poorly cleaned surfaces as well as their excellent corrosion resistance.

3. Steelmastic 168 manufactured by Steelcote Manufacturing Co., St. Louis, MO. This product was selected as being typical of the numerous aluminum epoxy mastics available in the market. These products are marketed as being easily applied over marginally cleaned steel as well as over existing coatings.

4. SSPC Paint 25 primer (SSPC: The Society for Protective Coatings specification for Red Iron Oxide, Zinc Oxide, Raw Linseed Oil & Alkyd Primer) followed with 2 coats of TT-P-38 (Federal specification for Paint, Aluminum, Ready Mixed). This is a standard paint system for the Corps of Engineers in the civil works guide specification CEGS 09965 (Painting: Hydraulic Structures). Paint 25 is a conventional slow drying long oil product having no lead or chromates. TT-P-38 is a 33 gallon oil length phenolic aluminum. The oil is 80% tung oil and 20 % alkali refined linseed oil.

5. Corps of Engineers Formula 19466 is a specially formulated aluminum epoxy mastic having a solids content of 76%.

6. Rustbond penetrating sealer manufactured by Carboline Co., St. Louis, MO was applied to some surfaces prior to the application of the above System 4. Rustbond is a 2 component polymeric amidoamine having excellent wetting properties. Due to the temperatures at the time of the application, a 'winter grade' product was used. The winter grade is specified for use between 10 – 32 °C (50 – 90 °F).

Product literature for the test coatings is reproduced in Appendix A. The coatings were applied to a steel railroad bridge at Cape Cod, MA. The surfaces of discrete test areas (all of the same approximate size) were prepared to four different degrees using different methods, as detailed in Chapter 2. Two field inspections of the coatings were conducted — once after 1 year of service and again after 5 years of service.

The main text of this report provides details on surface preparation, coating application, and field performance.

Units of Weight and Measure

U.S. standard units of measure are used throughout this report. A table of conversion factors for Standard International (SI) units is provided below.

SI conversion factors		
1 in.	=	2.54 cm
1 mil	=	0.0245 mm
1 sq ft	=	0.093 m^2
1 gal	=	3.78 L
1 lb	=	0.453 kg
1 psi	=	6.89 kPa
°F	=	(°C x 1.8) + 32

2 Field Test Summary and Results

Railroad Bridge Structure

The railroad bridge over the Cape Cod Canal is of riveted construction. The existing paint system consisted of red lead in oil primers (TT-P-68 Type I and Type II) and phenolic aluminum (TT-P-38) topcoats. The structure had been repainted numerous times without removing the existing coating. Some paint chips removed indicate 4 applications of the orange/aluminum paint system. Some of the removed paint revealed intact mill scale indicating the structure had never been completely blast cleaned. Total coating thickness was quite erratic but was mostly in the 500 – 750 μ (20 – 30 mil) range. At the time of the test application the coating had deteriorated beyond the time for optimum repainting. SSPC Vis 2 rust grade 8 – 9 was common on much of the higher vertical surfaces having few rivets; grade 5 was common on many riveted areas especially near the track bed; grade 0 was found in recesses where water was retained. Overall, there was virtually no pitting corrosion, no deformation of steel due to exfoliation, and a minimal number of rivet heads requiring replacement.

Each test area consisted of at least 50 sq ft. Some test areas were located on large girders located below and to the side of the tracks and others were located on the truss structure on the west side of the tracks. Some truss surfaces were eastern exposure and others were western exposure. Figure 1 shows the basic layout of the test areas and Table 1 identifies which coating systems were applied to which test areas.

Application of Test Coatings

Table 2 lists the film thicknesses specified in the painting contract. All test coatings were applied over each of four different degrees of surface preparation. The four degrees are described as follows:

A. SSPC SP5, *White Metal Blast Cleaning.* Grit blasting was used to produce an anchor profile of approximately 2.5 to 3.0 mils.

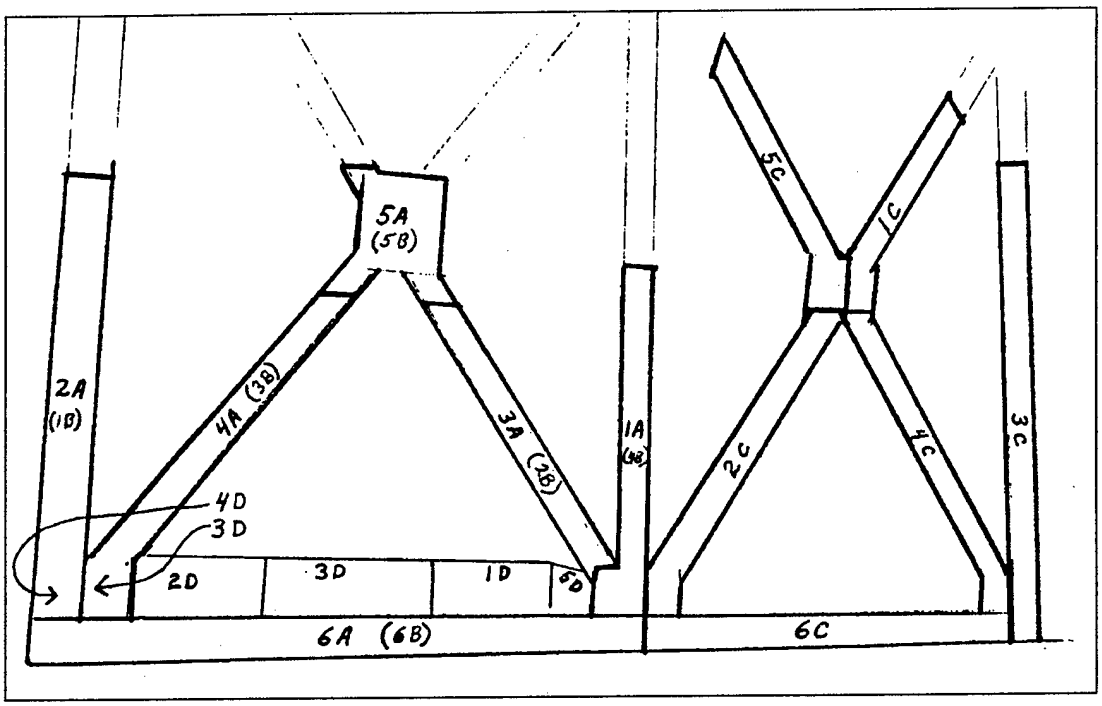


Figure 1. Diagram of paint test areas.

Table 1. Paint system designations.

Coating System	Area A	Area B	Area C	Area D
Surface Preparation	SSPC SP5	SSPC SP6	SSPC SP3	Existing Paint
Location	West exposure on superstructure	East exposure on superstructure	West exposure on superstructure	Girders below level of tracks
System #1 Amerlock400AL/ Amerlock400AL	1A	1B	1C	1D
System #2 Kolorane 9500/ Kolorane 9500	2A	2B	2C	2D
System #3 Steelmastic 168/ Steelmastic 168	3A	3B	3C	3D
System #4 SSPC Paint 25/ TT-P-38	4A	4B	4C	4D
System #5 CoE Formula 19466/ CoE Formula 19466	5A	5B	5C	5D
System #6 Rustbond Sealer/ SSPC Paint 25/ TT-P-38	6A	6B	6C	6D

Table 2. Film thickness required by contract.

Coating system	Sealer (applied to all surfaces)	Primer (applied to bare steel only)	Intermediate (applied over primer only)	Finish (applied to all surfaces
System #1 Amerlock400AL/ Amerlock400AL	---	5-8 mils	---	3-4 mils
System #2 Kolorane 9500/ Kolorane 9500	---	1.5-2.0 mils	---	1.5-2.0 mils
System #3 Steelmastic 168/ Steelmastic 168	---	6-8 mils	---	5-7 mils
System #4 SSPC Paint 25/ TT-P-38	---	2-3 mils	1.5-2.5 mils	1.5-2.5 mils
System #5 CoE Formula 19466/ CoE Formula 19466	---	5-8 mils	---	3-4 mils
System #6 Rustbond Sealer/ SSPC Paint 25/ TT-P-38	1-2 mils	2-3 mils	1.5-2.5 mils	1.5-2.5 mils

B. SSPC SP6, *Commercial Blast Cleaning*. Grit blasting was used to produce an anchor profile of approximately 2.5 to 3.0 mils.

C. SSPC SP3, *Power Tool Cleaning*. Power wire brushes were used.

D. Manual removal of dirt, grease, and loose coating material only.

Surface preparation A was thorough and met the requirements of the specification in all except tight areas around rivets. Surface preparation B was thorough in riveted areas but was less than specification requirements on flat areas where many traces of mill scale remained on the surface. Surface preparation C was thorough and met specification requirements. Surface preparation D was indeed minimal. No solvent cleaning was performed. Hand tool removal of loose coatings removed only some of the loosely attached coating leaving many other areas that, although not curled, were not adherent to the substrate.

All paint was applied by brush using a method typical for brush-applied coatings. Thickness requirements on flat areas were normally met; however, coatings were often thin on projections such as rivet heads.

Observations

All test coatings were observed and photographed after 1 year and again after 5 years. (See Appendix B for photos). Observations of each area are shown in order from the poorest appearance to the best appearance.

1-Year Observations

Area A, 1-year observations

All test coatings were providing perfect protection.

Area B, 1-year observations

Light rust was observed on many rivets in Systems 1B and 2B. All other test coatings were providing perfect protection.

Area C, 1-year observations

1C and 4C exhibited the poorest protection with many rivets exhibiting light rust.

2C, 3C, and 6C exhibited better protection with only a few rivets exhibiting light rust.

System 5C was providing perfect protection.

Area D, 1-year observations

4D exhibited the poorest protection including rusting rivets and numerous locations where rust was bleeding from loose edges of the existing coating.

1D exhibited the poor protection including minor rusting in flat areas as well as general rusting on some rivets.

5D exhibited fair to poor protection minor rusting in flat areas.

2D provided good protection but had obvious brush marks, which detracted from its appearance. These brush marks were not noted on other areas perhaps indicating this was the last area coated with this material and some curing had taken place prior to the application.

3D and 6D were providing excellent protection.

5-Year Observations

Area A, 5-year observations

All test coatings were providing very good protection on flat areas but traces of rust are visible on a high percentage of the rivets. There were no significant differences among the systems.

Area B, 5-year observations

2B and 1B both had rust on many rivets with 2B in slightly poorer condition with minor rust undercutting on some edges.

3B, 4B, and 5B were all providing excellent protection. Unfortunately, the test areas contain very few rivets to inspect for rust.

6B was providing excellent protection except on a few rivets where unsatisfactory surface preparation allowed residues of the original coating to remain.

Area C, 5-year observations

4C exhibited the poorest protection with many rivets rusting. There was light rust beginning in flat areas.

2C, 5C were good. 5C had a few rusting rivets. The 2C area had few rivets but minor rust undercutting was noted along edges.

1C was only slightly better than 5C.

3C exhibited very good protection however; the test areas had few rivets, a small percentage of which were exhibiting light rust.

6C was providing very good protection including in areas with many rivets. No difference was noted between 6A and 6C.

Area D, 5-year observations

4D exhibited the poorest protection with many rivets rusting and many areas of old coating pulling loose allowing rust to bleed from under the coating. There

was light rust beginning in areas where surface preparation had exposed bare substrate.

2D also exhibited the poor protection with general rusting in many rivet areas and areas of old coating pulling loose allowing rust to bleed from under the coating. There was light rust beginning in areas where surface preparation had exposed bare substrate.

1D exhibited minor rusting on flat areas as well as general rusting in rivet areas.

5D exhibited fair to poor protection including general rusting in flat areas and rust undercutting along edges of the original coating.

6D was beginning to exhibit general rusting in areas where bare substrate had been exposed during surface preparation.

3D was providing the best protection with only a minor amount of rust undercutting around rivets and along a bottom flange and slight rusting in areas where bare substrate had been exposed.

3 Conclusions and Recommendations

Conclusions

Part of the objective of this work was to test a number of coating systems as they would be field applied under a typical contract. It was thought that frequently contract requirements for the quality of the surface preparation, thickness of the paint, or perhaps other requirements of the contract are not fully met by the contractor. Such was the case on this test site. The contractor provided his own QC and the Corps' QA was not onsite while the work was being performed.

The requirement to for a White-Metal blast resulted in a thorough amount of abrasive blasting. The previous coatings remaining around rivets would not have met the specification requirement however this deficiency is unavoidable and typical of many White-Metal blast jobs. Similarly, the level of surface preparation performed in the Commercial grade areas was probably sufficient for the types of coatings applied; however, mill scale is not allowed by the specification. The amount of paint remaining around rivets and in areas the blasters missed would technically have reduced the rating of the surface preparation to the Brush-Off grade. The Power Tool grade of surface preparation met the specification requirements. The areas chosen for this grade were easily accessible making compliance easy with only a power wire brush. On these areas, minor rust undercutting was only noted on systems 2B, 2C, and 5C. The excellent resistance to rust undercutting at edges and the lack of any failures of adhesion to the substrate indicate these variations in surface preparation had no effect on the performance of the other coatings.

In the minimally prepared areas the contract writer probably had the SSPC Hand Tool Cleaning requirement in mind, but did not reference the specification. A putty knife was used to remove paint that had peeled away from the plane of the surface but other paint that had lost adhesion but had not curled was not removed. The areas chosen for this grade of surface preparation were the worst areas of the bridge having the greatest amount of initial corrosion as well as the greatest complexity. The areas also had the only horizontal surfaces (top and bottom flanges of the girder). This level of surface preparation as well as the configuration of the test areas had a strong effect on the performance of the various coatings. After 1 year systems 2D, 3D and 6D were all providing complete

protection but probably through different mechanisms. 3D was a heavy mastic that tended to encapsulate the existing coating while 2D had the ability to penetrate under loose edges due to its resin. System 6D used a separate penetrating sealer to penetrate under the edges of poorly adherent coating and provide a base for the same coatings as used for system 4D. In contrast, system 4D provided the poorest protection primarily because it did not bridge over the edges of poorly adherent coatings nor did it penetrate sufficiently under the edges to provide protection.

The effects of thinner than specified applications were noted after only 1 year. At the end of 5 years, the effects were more extensive affecting more areas and detracting from the appearance of the coating system but not resulting in any significant destruction of the substrate. In general, the coatings were probably brushed thinner than specification requirements on projections such as rivets. This lead to rust showing through coatings after only 1 year. After 5 years rust was showing through some of the coatings in areas where surface preparation had exposed the substrate. Poorest of the coatings in this respect were 4 and 2, both of which used low film build coatings. Best of the systems in this respect were 3 and 6. Of all the systems applied, system 3 had the greatest film thickness requirement as well as a capability, according to the tech data sheet, of being able to be applied at a 25 mil film thickness in a single coat. System 6 was the only 4 coat system. It did not appear that chalking was a factor in reducing the thickness of any of the coatings.

Recommendations

1. Based on the 5-year study, quality control of coating thickness had the greatest impact on coating performance. When coatings are brush applied there is a normal tendency to brush the coating thin, especially on projections such as rivet heads. Magnetic thickness gages are not accurate on such projections making measurement impractical. Spray application usually results in more uniform thicknesses. QC/QA inspectors should be conscious of these tendencies and promote uniform applications by painters.

2. The philosophy of "Better surface preparation results in better coating performance" is only valid to some limit. With the coatings in this study, it was not found that White Metal Blasting resulted in better coating performance than Commercial Blasting. Indeed, areas where Power Tool Cleaning allowed existing sound coatings to remain also resulted in excellent coating performance of some of the systems. Prior to specifying surface preparation, the existing coating system should be critically evaluated to determine if it can be successfully main-

tained with touch-up and overall topcoat or if total removal is necessary. When total removal is indicated, the need for high quality surface preparation should be critically evaluated because the extra expense may not result in greater coating performance.

3. The penetrating sealer used in System #6 greatly added to the performance of the standard Corps coating system on the minimally cleaned test areas. Such a low grade of surface preparation is not recommended by Corps guide specifications and (hopefully) is seldom allowed within the Corps. However, on areas where surface preparation is extremely low the product should be applied for increased coating life. The standard system should provide satisfactory performance without the added sealer when applied according to guide specification requirements.

4. The aluminum epoxy mastic (System #3) performed very well on all surface preparations. Since the initiation of this test program the Corps has developed a Commercial Item Description (CID A-A-3127) for these types of coatings and incorporated it into guide specification CEGS 09965. Recommendations regarding its use are included in the guide specification.

Appendix A: Technical Data on Products Applied

In this appendix technical data are provided for all products applied except System 4. This consisted of SSPC Paint 25 primer and two topcoats of TT-P-38, and is fully described in CEGS09965, Painting: Hydraulic Structures.

System 1

Amerlock 400

High-solids epoxy coating

Product Data

- VOC compliant
- High-performance general maintenance coating for new or old steel
- Cures through wide temperature range
- Self-priming topcoat over most existing coatings
- Can be overcoated with wide range of topcoats
- Compatible with prepared damp surfaces
- Compatible with adherent rust remaining on prepared surfaces
- 5 mils or more in a single coat
- Resists high humidity and moisture

Amerlock's low solvent level meets VOC requirements, reduces the chances for film pinholing and solvent entrapment at the substrate-coating interface, often a major cause of coating failure with conventional epoxies and lower solids systems. Amerlock 400 is available in a variety of colors, including aluminum, and therefore does not require a topcoat. For extended weatherability or special uses, a topcoat may be desired.

Typical Uses

Amerlock 400 is used in those areas where blasting is impractical or impossible. As a maintenance coating, Amerlock400 protects steel structures in industrial facilities, bridges, tank exteriors, marine weathering, offshore, oil tanks, piping, roofs, water towers and other exposures. Amerlock 400 has good chemical resistance to splash/spillage, fumes and immersion in neutral, fresh and salt water (see resistance table). Contact your Ameron representative for specific information.

Typical Properties

Physical

Abrasion resistance (ASTM D4060)	
1 kg load/1000 cycles	weight loss
CS- 17 wheel	102 mg
Impact resistance (ASTM D2794)	
Direct	24 in – lb
Reverse	6 in - lb
Moisture vapor transmission (ASTM F 1249)	
	4.49 g/m^2
Adhesion (ASTM D4541)	900 psi

Performance

Salt spray (ASTM B 117) 3000 hours	
Face blistering	None
Humidity (ASTM D2247) 750 hours	
Face corrosion, blistering	None
Immersion (NACE TM-01-69) fresh water I year	
blistering	None

Physical Data

Semigloss Finish

Color: Standard, Rapid Response, custom colors and aluminum

White and light colors may show yellowing on aging. Use ofAmercoat 861 with white or light colors will slightly discolor Do not use with 400FD cure. With white and light colors, 400FD cure will cause yellowing.

Yellow, red and orange colors w1llfadefaster than other colors due to the replacement of lead-based pigments with lead-free pigments in these colors

Components	2	
Curing mechanism: Solvent release and chemical reaction between components		
Volume solids (ASTM D2697 modified)		
400	83%± 3%	
400AL	88%± 3%	
Dry film thickness (per coat)	5-8 mils (125-200 microns)	
Coats	1 or 2	
Theoretical coverage	ft|/gal	ml/L
1 mil (25 microns)		
400	1331	32.6
400AL	1412	34.7
5 mils (12 5 microns)		
400	266	6.5
400AL	282	6.9
VOC	lb/gal	WL
400 mixed	1.4	168
mixed/thinned (1/2 pt/gal)	1.7	204
400AL mixed	1.0	120
mixed/thinned (11/2 pt/gal)	2.0	240
400FD mixed	1.2	144
mixed/thinned (1/2 pt/gal)	1.6	192

Temperature resistance,	wet		dry	
	°F	°C	°F	°C
continuous	100	38	200	93
intermittent	100	38	350	177

Flash point (SETA)	°F	°C
400 resin	131	55
400 cure	85	29
400FD cure	87	30
400AL resin	110	43
400AL cure	116	47
Arnercoat' 8	67	19
Amercoat 65	78	25
Amercoat 12	0	-18

Qualifications

USDA - Incidental food contact

NFPA - Class A

NSF Standard 61 - For use in drinking water; Amerlock 400 and 400FD - White, Ivory and RT - 1805 Blue, *Certain restrictions do apply.*

Chemical Resistance Guide

System 1 continued

Environment	Immersion		Splash and Spillage		Fumes and Weather	
	400	400AL	400	400AL	400	400AL
Acidic			F	F	G	G
Alkaline			E	G	E	E
Solvents			G	G	E	E
Salt water	E	E	E	E	E	E
Water	E	E	E	E	E	E

F-Fair G-Good E-Excellent

**Contact your Ameron representative*

This table is only a guide to show typical resistances ofAmerlock 400 and 400AL. For specific recommendations, contact your Ameron representative representative for your particular corrosion protection needs.

Systems using Amerlock 400 or 400AL

1st coat	2nd Coat***	3rd coat
400	None	None
400	450HS	None
	Amershield-	None
400**	400	None
Dimetcotel 9, 9FT or 21-9	400	None
Dimetcote 9, 9FT or 21-9	400	None

***Water immersion.*

****For color contrast when 2 coats of400AL are used, 400AL red can be used asfirst coat.*

Recoat/Topcoat time		°F/°C	
minimum (hours)	90/32	70/21	50/10
400	8	16	30
400 with 1 pt 861	4	7	16
400FD	2	31/2	10
400AL	3	12	48
400AL with 1/2 pt 861	3	5	12

Recoat/Topcoat time @ 70°F (21°C)

System	Maximum time
400/400	3 months
400 with 861/400	1 month
400FD/400FD	2 weeks
400/Amershield or 450HS	1 month
400/5405	1 day
400FD/Amershield or 450HS	7 days
400 with 86 1/Amershield or 450HS	2 weeks

Note: If maximum time is exceeded, roughen surface. For topcoats (finish coats) not listed, see Product Data sheet for specific topcoat time limitations.

Application Data Summary

See Application Instructions for complete information on surface preparation, environmental conditions, application procedures and equipment. To obtain maximum performance, apply as recommended. Adhere to all safety precautions during storage, handling, application and drying periods

Surface Preparation

Coating performance is, in general, proportional to the degree of surface preparation. Abrasive blasting is usually the most effective and economical method. When this is impossible or impractical, Amerlock 400 can be applied over mechanically cleaned surfaces. All surfaces must be clean, dry and free of all contaminants, including salt deposits.

Application Data

Applied over steel, concrete, aluminum, galvanizing
Surface preparation
Steel: SSPC-SP2, 3, 7 or 10
Concrete: ASTM D4259 or 4260
Aluminum: Alodine®, Alumiprep® or light abrasive blast
Galvanizing: Galvaprep"l or light abrasive blast

Method: Airless or conventional spray. Brush or roller may require additional coats.

Mixing ratio (by volume) 1 part resin to I part cure

Pot life (hours)				°F/°C	
861 Accelerator amount	Amerlock /mixed 5 gal	90/32	70/21	50/10	32/0
None	400	11/2	21/2	4	7
	400AL	31/2	51/2	10	15
	400FD	1	11/2	21/2	4
1/2 pt	400	1	11/2	21/2	4
	400AL	1	11/2	21/2	4
1 pt	400	1/ 2	1	11/2	2

Pot life is the period of time after mixing that a five-gallon unit of material is sprayable when thinned as recommended. Mixture may appear fluid beyond this time, but spraying and film build characteristics may be impaired

Environmental conditions

Product	Air and Surface Temperature
Amerlock 400 or 400 AL	40° to 122°F (4° to 50°C)
Amerlock with 861	20° to 122°F (-6° to 50°C)
Amerlock 400FD cure	20' to 122'F (-6' to 50°C)

Surface temperatures must be at least 5°F (3°C) above dew point to prevent condensation. At freezing temperatures, surface must be free of ice.

Do not use A merlock 400AL on water damp surfaces. Do not use 400FD cure with 400-4L resin.

Drying time (ASTM D 1640) (hours)

				touch °F/°C			
861 Amerlock Amt /mixed 5 gal		120/49	90/32	70/21	50/10	32/0	20/-6
None	400	11/2	41/2	9	28	96	NR
	400AL	1	4	12	36	96	NR
	400FD cure	1/2	1	2	8	24	48
1/2 pt	400	11/2	3	5	24	72	120
	400AL	1	11/2	21/2	5	10	24
1 pt	400	1	2	4	15	48	96
				through			
None	400	6	12	20	40	140	NR
	400AL	11/2	V/2	24	72	216	NR
	400FD cure	11/2	21/2	41/2	13	38	96
1/2 pt	400	3	6	10	30	96	180
	400AL	2	4	9	24	48	120
1 pt	400	21/2	5	9	24	72	160

System 1 continued

		Cure for Immersion (days)					
None	400	2	4	7	21	NR	NR
	400AL	2	4	7	21	NR	NR
	400FD cure1		2	3	7	21	NR
1/2 Pt	400AL	1	2	3	7	21	NR
1 pt	400	1	2	3	7	21	NR

Amercoat 861 Accelerator will slightly discolor Amerlock 400 white and other Amerlock light colors. Do not use 861 Accelerator with 400FD cure.

NR = Not recommended

Safety Precautions

Read each component's material safety data sheet before use. Mixed material has hazards of both components. Safety precautions must be strictly followed during storage, handling, and use.

This product is for industrial use only. Not for residential use in California

Warranty

Ameron warrants its products to be free from defects in material and workmanship. Ameron's sole obligation and Buyer's exclusive remedy in connection with the products shall be limited, at Ameron's option, to either replacement of products not conforming to this Warranty or credit to Buyer's account in the invoiced amount of the nonconforming products. Any claim under this Warranty must be made by Buyer to Ameron in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or one year from the delivery date, whichever is earlier. Buyer's failure to notify Ameron of such nonconformance as required herein shall bar Buyer from recovery under this Warranty.

Ameron makes no other warranties concerning the product. No other warranties, whether express, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply. In no event shall Ameron be liable for consequential or incidental damages.

Any recommendation or suggestion relating to the use of the products made by Ameron, whether in its technical literature, or in response to specific inquiry, or otherwise, is based on data believed to be reliable; however, the products and information are intended for use by Buyers having requisite skill and know-how in the industry, and therefore it is for Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. Variation in environment changes in procedures of use, or extrapolation of data may cause unsatisfactory results.

Thinner	Amercoat 8 or 65
Equipment cleaner	Thinner or Amercoat 12

Shipping Data

Packaging unit	2 gal	5 gal
cure	1 -gal can	2.5-gal can
resin	1 -gal can	2.5-gal can
Shipping weight (approx)	lbs	kg
2-gal unit		
400 cure	12.5	5.7
400FD cure	2.2	5.5
400 resin	13.7	6.2
400AL cure	2.1	5.5
400AL resin	11.0	5.0
5 -gal unit		
400 cure	31.8	14.4
400FD cure	31.2	14.2
400 resin	35.0	15.9
400AL cure	30.9	14.0
400AL resin	28.3	12.8

Shelf life when stored indoors at 40°to 100°F (4° to 38°C)
resin and cure 1 year from shipment date

Numerical values are subject to normal manufacturing tolerances, color and testing variances. Allow for application losses and surface irregularities.

This mixed product is photochemically reactive as defined by the South Coast Air Quality Management District's Rule 102 or equivalent regulations.

Limitation of Liability

Ameron's liability on any claim of any kind, including claims based upon Ameron's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in no case exceed the purchase price allocable to the products or part thereof which give rise to the claim. **In no event shall Ameron be liable for consequential or incidental damages.**

System 2

KOLORANE ALUMINUM PRIMER

No. 9500 SERIES

GENERIC TYPE:	AROMATIC MOISTURE CURED URETHANE	
PRODUCT DESCRIPTION:	A single component, aluminum primer that cures rapidly to a hard, solvent and chemical resistant finish. It shows exceptional ability to adhere to irregular surfaces, even with minimal surface preparation.	
RECOMMENDED USES:	As a corrosion resistant primer or primer/finish (multi-coat system) over blasted, or power or hand tool cleaned, slightly rusted steel. Also suitable for priming concrete floors, where only minimal surface preparation is possible, and as a "barrier coat" between solvent sensitive coatings and either urethanes or epoxies.	
NOT RECOMMENDED FOR:	Areas where the relative humidity is less than 30%.	
COMPATIBLE UNDERCOATS:		
COMPATIBLE TOPCOATS:	Kolor-Poxy Hi-Build Enamels Kolor-Poxy Enamels Kolorane Enamels Acrythane Enamels Acrythane Intermediate Primer	
PRODUCT CHARACTERISTICS:	**Solids by Volume:**	56% ± 3%
	Solids by Weight:	64% ± 3%
	Recommended Dry Film Thickness:	1.5 - 2.5 mils
	Theoretical Coverage:	450 Sq. Ft./Gallon @ 2.0 mils DFT
	Finish:	Metallic Luster
	Available Colors:	Aluminum (9500) and Light Green Aluminum (9510)
	Drying Time @ 72°F:	To Touch: 2 Hours To Handle: 4 Hours To Recoat: 6 Hours
	VOC Content:	3.15 Pounds/Gallon 377 Grams/Liter
	Weight per gallon:	9.3 ± 0.5 (pounds)
	Flash Point (Pensky-Martens):	96 ± 3°F

System 2 continued

PHYSICAL DATA:	**Shelf Life:**	6 Months
	Pot Life @ 72°F:	
	Temperature Resistance:	350°F
	Viscosity @ 77°F:	63 ± 5 (Krebs Units)
	Gloss (60° meter):	Metallic Luster
	Storage Temperature:	45 - 95°F
	Mixing Ratio (Approx. By Vol.):	
APPLICATION DATA:	**Application Procedure Guide:**	APG-5
	Wet Film Thickness Range:	3.0 - 4.5 mils
	Dry Film Thickness Range:	1.5 - 2.5 mils
	Temperature Range:	20 - 100°F
	Relative Humidity:	30% Minimum
	Substrate Temperature:	Dew Point + 5°F
	Minimum Surface Preparation:	SSPC-SP2, SP3, SP6
	Induction Time @ 72°F:	
	Recommended Solvent:	No. 1200
	Application Methods	
	Air Spray Tip Size: .055" Pressure: 30 - 60 PSIG Thin: Thinning Not Recommended Airless Spray Tip Size: .013" - .017" Pressure: 2000 - 2500 PSIG Thin: Thinning Not Recommended Flow Coat Viscosity: 19 - 21 SEC. (Sears Cup) Brush or Roller Thin: Thinning Not Recommended	

System 3

Steelcote Manufacturing Co.

ENGINEERING SERVICE

PDS No. 0773

STEELMASTIC 168

ONE STEELCOTE SQUARE • ST. LOUIS, MO 63103-2990 • (314) 771-8053 • FAX (314) 771-7581

SELECTION DATA

GENERIC TYPE: High Build Aluminum Epoxy Mastic

PRODUCT DESCRIPTION: Steelmastic 168 is a surface tolerant, self-priming, direct-to-rust, high build maintenance coating designed to give excellent water, chemical and corrosion protection to a wide variety of substrates in the minimum number of coats. Its superior adhesion properties allow it to be applied over marginally prepared rusted steel and old existing coatings. Steelmastic 168 exhibits an affinity towards covering and protecting edges and corners where most coatings have a tendency to pull away. Its high build formulation allows it to obtain a high performance barrier up to 25 mils (625 microns) thick in a one-coat application. U.S.D.A. acceptable for incidental contact in food processing and packaging plants

RECOMMENDED FOR: Excellent coating for bridges, pipes, fences, machinery, structural steel or tank exteriors, especially when corrosion of the steel has taken place. May be applied over most old coatings, inorganic or organic zinc rich primers where optimal performance is desired.

NOT RECOMMENDED FOR: Immersion other than salt or fresh water. Do not apply in temperatures below 50°F. (10°C.)

PHYSICAL PROPERTIES

RESISTANCE TO: (Splash & Spillage)	
Acids:	Fair - Good
Alkali:	Very Good
Salts:	Excellent
Solvent:	Fair - Good
Water:	Excellent
VOLUME SOLIDS:	85% +/- 2%
WEIGHT SOLIDS:	90% +/- 2%
MIX RATIO, WEIGHT:	100 Part B to 60.2 Part A
MIX RATIO, VOLUME:	One Part B to One Part A
FLASH POINT:	80°F. (27°C.) TCC
POT LIFE:	8 hours
SHELF LIFE:	1 Year, Minimum
INDUCTION TIME:	30 Min.
THINNER - REDUCTION:	Steelcote T-300
THINNER - CLEAN UP:	Steelcote T-300
APPLICATION TEMPERATURE:	50° - 100°F. (10° - 38°C.)
SERVICE TEMPERATURE:	250°F. (120°C.) Maximum
GLOSS:	Semi-Gloss
COLOR:	Aluminum
PACKAGING:	2 gal and 10 gal units
WEIGHT PER GALLON:	10.2 lbs (4.6 kg) ± 2%
V.O.C. (Volatile Organic Compound):	1.25#/gal (150 g/l) mixed 2.15#/gal (258 g/l) thinned mixed

COVERAGES

THEORETICAL COVERAGE:
1,360 sq. ft. per gallon at 1 mils (25 microns) DFT (allow for application losses)

RECOMMENDED WET FILM THICKNESS:
6 mils (150 microns)

RECOMMENDED DRY FILM THICKNESS:
5 mils (125 microns) minimum
25 mils (525 microns) maximum

DRYING TIME

@ 77°F. (25°C.) 50% RH

TO TOUCH:	8 - 10 Hours
TO RECOAT:	24 Hours
FINAL CURE:	7 Days

RECOMMENDED FINISH COATS

Steelmastic 168 is designed as a primer/finish coat, but may be used over zinc rich shop coats.

Two-Package Urethane:	Epo-Lux Nos. 595 and 600
Epoxy-Polyamide:	Epo-Lux 121 or Epo-Lux 150
Epoxy Polyester:	Tile-X 2000

System 3 continued

SURFACE PREPARATION

TO CONCRETE: Steelmastic 168 is not generally used as a primer or finish coat on concrete. Consult Steelcote's Technical Service Department for optional systems.

TO STEEL: Surface must be clean and free from oil, grease, moisture and loose matter. Clean by solvent wiping with T-300 in accordance with SSPC-SP1 specification. Follow by hand or power tool cleaning in accordance with SSPC-SP2 or SSPC-SP3 specifications in order to remove all loose rust or mill scale. For severe environments, dry abrasive blast in accordance with SSPC-SP7 (Brush-Off) specification to remove loose rust, mill scale, paint and other foreign matter from the surface. Remove all dust.

TO GALVANIZED STEEL: Surface must be clean and free from all oil, grease, moisture and loose matter. Degrease by solvent wiping with T-300 in accordance with SSPC-SP1 specification. For white rust or weathered (red-oxide rusting) galvanized steel, prepare by hand or power tool cleaning in accordance with SSPC-SP2 or SSPC-SP3 specifications in order to remove any loose rust or scale. Remove any dust. Apply Steelmastic 168 per label instructions. Do not apply over moist or damp surfaces. Clean all tools and equipment with Steelcote T-300 reducer after use.

TO EXISTING COATINGS: Apply only over clean, sound coatings. If the existing coating is brittle, eroded, or under film rusting exists, or if less than 75% of the film is intact, the coating must be totally removed by brush-blasting (SSPC-SP7) or other specified method. For sound existing coatings that are greater than 75% intact, remove any oil, grease, dirt or foreign matter by wiping with Steelcote Bond-Prep in accordance with SSPC-SP1 specification. Remove any remaining gloss or loose existing coating by hand or power tool cleaning in accordance with SSPC-SP2 or SSPC-SP3 specifications. Spot prime bare areas with Steelmastic 168 and allow to dry. Apply Steelmastic 168 over the entire existing coating and spot-primed areas per label instructions. Do not apply over moist or damp surfaces. Clean all tools and equipment with Steelcote T-300 after use.

APPLICATION EQUIPMENT

BRUSH: Use a clean, natural bristle brush. Reduce 15% with Steelcote T-300 if necessary.

ROLL: Use a clean, short nap mohair roller with a phenolic core (EZ Paintr® or equivalent). Reduce 15% with T-300 if necessary.

CONVENTIONAL SPRAY			AIRLESS SPRAY	
Gun:		Binks 18 or equal	Pump Ratio:	30:1
Fluid Nozzle:		66	Gun:	Graco 205-592 or equal
Air Nozzle:		66 SF	Tip Size:	0.019 - 0.021
Air Hose ID:		5/16"	Fan Size:	8" - 10"
Material Hose ID:		3/8"	Pressure:	2500 - 3000 psi
Needle:		65	Material Hose ID:	3/8"
Pressure:	Pot:	15 - 20 psi		
	Atomization:	60 - 90 psi		
Use moisture and oil traps. Reduce up to 15% if necessary with Steelcote T-300.			Reduce up to 15% if necessary with Steelcote T-300.	

796

Formulation # 19466

FORMULATION TITLE Aluminized Epoxy Mastic (Bourne Bridge)

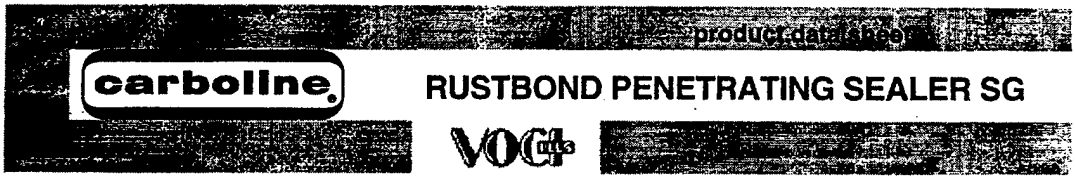
Client Corps of Engineers

CODE		INGREDIENTS	LBS	GALS	MANUFACTURER	SOLID WEIGHT	SOLID VOLUME	PIGMENT WEIGHT	PIGMENT VOLUME	PIG. VOL. OF UNITY	CRITICAL PIG. VOL	VEHICLE WEIGHT	VEHICLE VOLUME	SOLVENT WEIGHT	SOLVENT VOLUME	NON-AQU. SOL. WGT.	AQUEOUS VOLUME	WET VOL LESS AQU.
COMP. A		Epon 828	300.7	31	Shell	300.7	31					300.7	31	0	0	0	0	31
		MPA-1078	8	1.081081	Rheox	3.2	0.42162					3.2	0.42162	4.8	0.659459	4.8	0	1.08108108
		Mix Well Under Agitation to 120°F Then add slowly under mild agitation																
		Silberline L-243	125.38	10.16869	Silberline	81.497	3.62310	81.497	3.623105	0.275856	28.58246							
		Aromatic 100	45.5	6.275862	EXXON	0	0							43.683	6.545588	43.683	0	10.1686942
			479.58	48.52583		385.397	35.0447	81.497	3.623105	0.275856		303.9	31.4216	45.5	6.275862	45.5	0	6.27586206
														94.183	13.48091	94.183	0	46.5256373
COMP.B		Ancamide 2050	241.57	29	Pacific Anchor	241.57	29					241.57	29	0	0	0	0	29
		MPA-1078	8	1.081081	Rheox	3.2	0.42162					3.2	0.42162	4.8	0.659459	4.8	0	1.08108108
		10 Wollastokup AS	220	9.090909	NYCO	220	9.09090	220	9.090909	0.692165	50.27130			0	0	0	0	9.09090909
		Mix Well Under Agitation																
		Cabosil TS 720	10	0.42	Cabot	10	0.42	10	0.42	0.031976	29.36758							
		Grind Until 120°F												0	0	0	0	0.42
		Aromatic 100	43.01	5.932413	EXXON	0	0											
		Diacetone Alcohol	23.46	2.996168	Union Carbide	0	0							43.01	5.932413	43.01	0	5.93241379
			546.04	48.52057		474.77	38.9325	230	9.510909	0.724143		244.77	29.4216	23.46	2.996168	23.46	0	2.99616858
		TOTAL	1025.62	97.04620		660.167	73.9772	311.497	13.13401	1	0.617365	548.67	60.8432	71.27	9.588041	71.27	0	48.5205725
														165.453	23.06895	165.453	0	97.0462099

Formulation Constants

Non Volatile by Weight	0.838680	Weight/Gallon Comp A	9.88302
Non Volatile by Volume	0.762266	Weight/Gallon Comp B	11.2537
PVC	0.177541	Mixing Ratio	1.00010
CPVC	0.617365	Weight per Gallon	10.5583
PVC/CPVC	0.287578	Cost per Gallon	0
Pigment Content	0.303715		
NVV % by wt. of Vehicle	0.768313		
VOC grms/litre	204.0410		
VOC lbs/gal	1.704868		

System 6



SELECTION DATA

GENERIC TYPE: Cross linked epoxy

GENERAL PROPERTIES: A penetrating sealer with excellent wetting properties. It is highly flexible with good chemical and solvent resistance and accepts a wide variety of topcoats.

- Universal primer and tie coat
- Excellent adhesion to minimal surface preparation
- Low Stress
- Extremely high solids
- Low odor
- Meets VOC (Volatile Organic Content) regulations
- Contains corrosion inhibitors
- Green tint improves visibility

RECOMMENDED USES: As a sealer for marginally prepared steel and over old coatings. Its excellent wetting properties allows it to penetrate rust and discontinuities in existing coatings to provide a firm anchorage for a variety of topcoats. Its thixatropic character reduces run off, ensuring that the edges of existing coatings are covered thus reducing undercutting and peeling.

May also be used as a primer for various non-ferrous metals, including aged and new galvanized steel which is free of white rust inhibiting chemicals or oils, and as a tie coat for coatings that have exceeded their "recoat window".

NOT RECOMMENDED FOR: Immersion service or any application without a topcoat.

TYPICAL CHEMICAL RESISTANCE: Depends on topcoat.

TEMPERATURE RESISTANCE: (Non-Immersion)

Continuous:	175°F	(80°C)
Non-Continuous:	200°F	(93°C)

SUBSTRATES: Apply over properly prepared metal or other surfaces as recommended.

COMPATIBLE COATINGS: May be applied over most coatings. A test patch is recommended over existing coatings. May be topcoated with most epoxies, polyurethanes, drying oils, alkyds and acrylics.

SPECIFICATION DATA

THEORETICAL SOLIDS CONTENT OF MIXED MATERIAL:

	By Volume
RUSTBOND PENETRATING SEALER SG	99% ± 1%

VOLATILE ORGANIC CONTENT (VOC): The following are nominal values:
As supplied: 0.2 lbs/gal (24 g/l)
Per EPA Method 24: 0.7 lbs/gal (85 g/l)

RECOMMENDED DRY FILM THICKNESS PER COAT:
1-2 mils (25-50 microns)

Puddles on horizontal surfaces should be minimized.

THEORETICAL COVERAGE PER MIXED GALLON:
1572 mil ft^2 (38.5 m^2/l at 25 microns)
786 ft^2 at 2 mils (19.3 m^2/l at 50 microns)

Mixing and application losses will vary and must be taken into consideration when estimating job requirements.

STORAGE CONDITIONS: Store indoors.
Temperature: 40-110°F (4-43°C) Humidity: 0-90%
Bring material temperature up to 75°F (24°C) before use.

SHELF LIFE: 24 months when stored indoors at 75°F (24°C).

COLOR: Translucent Green (0300)

FINISH: Gloss. Chalks rapidly in sunlight.

ORDERING INFORMATION

Prices may be obtained from your Carboline Sales Representative or Carboline Customer Service.

APPROXIMATE SHIPPING WEIGHT:

	0.5 Gal Kit	2 Gal Kit
RUSTBOND PENETRATING SEALER SG	6 lbs (2.7 kg)	22 lbs (10 kg)

FLASH POINT: (Setaflash)

RUSTBOND PENETRATING SEALER SG Part A	>205°F	(>96°C)
RUSTBOND PENETRATING SEALER SG Part B	176°F	(80°C)

Aug 98 Replaces May 97 (0922)

System 6 continued

APPLICATION INSTRUCTIONS
RUSTBOND PENETRATING SEALER SG

These instructions are not intended to show product recommendations for specific service. They are issued as an aid in determining correct surface preparation, mixing instructions and application procedures. It is assumed that the proper product recommendations have been made. These instructions should be followed closely to obtain the maximum service from the materials.

SURFACE PREPARATION: Remove all oil or grease from the surface to be coated with Thinner 2 or Carboline Surface Cleaner 3 (refer to Surface Cleaner 3 instructions) in accordance with SSPC-SP 1.

Steel: Hand Tool or Power Tool clean in accordance with SSPC-SP 2 or SSPC-SP 3.

Galvanized Steel: Wash with Carboline Surface Cleaner 3 and rinse thoroughly. Solvent wiping is not recommended.

Existing Coatings: A test patch is recommended to verify compatibility with existing coatings to evaluate the adhesion to any existing coatings and the adhesion of existing coatings to the substrate.

MIXING: Power mix the Part A, then slowly add the Part B and mix in the proportions listed below. Keep the mixing blade at slow speed and submerged in the product to minimize whipping of air into the material. Mix to blend thoroughly. Scrape the sides of the container occasionally to insure uniformity. Continue to mix for 1-2 minutes.

	0.5 Gal Kit	2 Gal Kit
RUSTBOND PENETRATING SEALER SG Part A	1 qt	1 gal
RUSTBOND PENETRATING SEALER SG Part B	1 qt	1 gal

THINNING: Thinning is not recommended. For spray applications, may be thinned up to 6 oz/gal (5%) with Thinner 76.

Use of thinners other than those supplied or approved by Carboline may adversely affect product performance and void product warranty, whether express or implied.

POT LIFE: In 1/2 gallon quantities:

Temperature	RUSTBOND PENETRATING SEALER SG
70°F (21°C)	80 Minutes
80°F (27°C)	50 Minutes
90°F (32°C)	40 Minutes
100°F (38°C)	30 Minutes

CAUTION: This product exotherms at the end of its pot life. Any unused quantities may become extremely hot and may generate smoke and fumes. The material begins to thicken at the end of its pot life which is an indication of the onset of exotherm. Immediately spread out on an appropriate surface or add sand or other suitable heat sink to the unused material to reduce the severity of exotherm. Take appropriate precautions against breathing fumes.

APPLICATION CONDITIONS:

	Material	Surface	Ambient	Humidity
Normal	70-90°F (21-32°C)	80-100°F (27-38°C)	80-100°F (27-38°C)	0-80%
Minimum	60°F (16°C)	70°F (21°C)	70°F (21°C)	0%
Maximum	100°F (38°C)	130°F (54°C)	110°F (43°C)	90%

Do not apply when the surface temperature is less than 5°F or 3°C above the dew point.

Special application techniques may be required above or below normal conditions.

SPRAY: May be applied by conventional, airless or plural component. Please contact Carboline Technical Service for specific application instructions.

BRUSH: Distribute evenly using full brush strokes.

ROLLER APPLICATION: Use a roller suitable for solvent base materials, to evenly distribute the material. Nap length will depend on the roughness of the substrate.

Apply only enough material to uniformly wet the surface. Any puddles formed must be brushed out.

DRYING TIMES: These times are based on a dry film thickness of 2 mils (50 microns). Excessive film thickness, insufficient ventilation or cooler temperatures will require longer cure times.

Surface Temperature	Dry to Handle	Dry to Topcoat	Final Cure
70°F (21°C)	34 Hours	18 Hours	9 Days
80°F (26°C)	22 Hours	12 Hours	6 Days
90°F (32°C)	14 Hours	9 Hours	4 Days
100°F (38°C)	11 Hours	4 Hours	3 Days

Maximum Recoat Times @ 75°F (24°C):

Surface Temperature	Epoxies & Polyurethanes	Acrylics & Alkyds
50°F (10°C)	30 Days	14 Days
75°F (24°C)	30 Days	14 Days
90°F (32°C)	15 Days	7 Days

If the maximum recoat times have been exceeded, the surface must be abraded by sweep blasting or application of another coat of Rustbond Penetrating Sealer SG prior to the application of any additional coatings.

CLEAN UP: Use Thinner 2

CAUTION: READ AND FOLLOW ALL CAUTION STATEMENTS ON THIS PRODUCT DATA SHEET AND ON THE MATERIAL SAFETY DATA SHEET FOR THIS PRODUCT.

Aug 98 Replaces May 97 (0922)

CAUTION: CONTAINS COMBUSTIBLE SOLVENTS. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CONFINED AREAS, WORKERS MUST WEAR FRESH AIRLINE RESPIRATORS. HYPERSENSITIVE PERSONS SHOULD WEAR GLOVES OR USE PROTECTIVE CREAM. ALL ELECTRIC EQUIPMENT AND INSTALLATIONS SHOULD BE MADE AND GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. IN AREAS WHERE EXPLOSION HAZARDS EXIST, WORKERS SHOULD BE REQUIRED TO USE NONFERROUS TOOLS AND TO WEAR CONDUCTIVE AND NON-SPARKING SHOES. IN CASE OF SPILLAGE, ABSORB AND DISPOSE OF IN ACCORDANCE WITH LOCAL APPLICABLE REGULATIONS.

carboline

Appendix B: Photos of Test Structure

Figure 2. Segment of railroad bridge over Cape Cod Canal used for 1994 coatings field test.

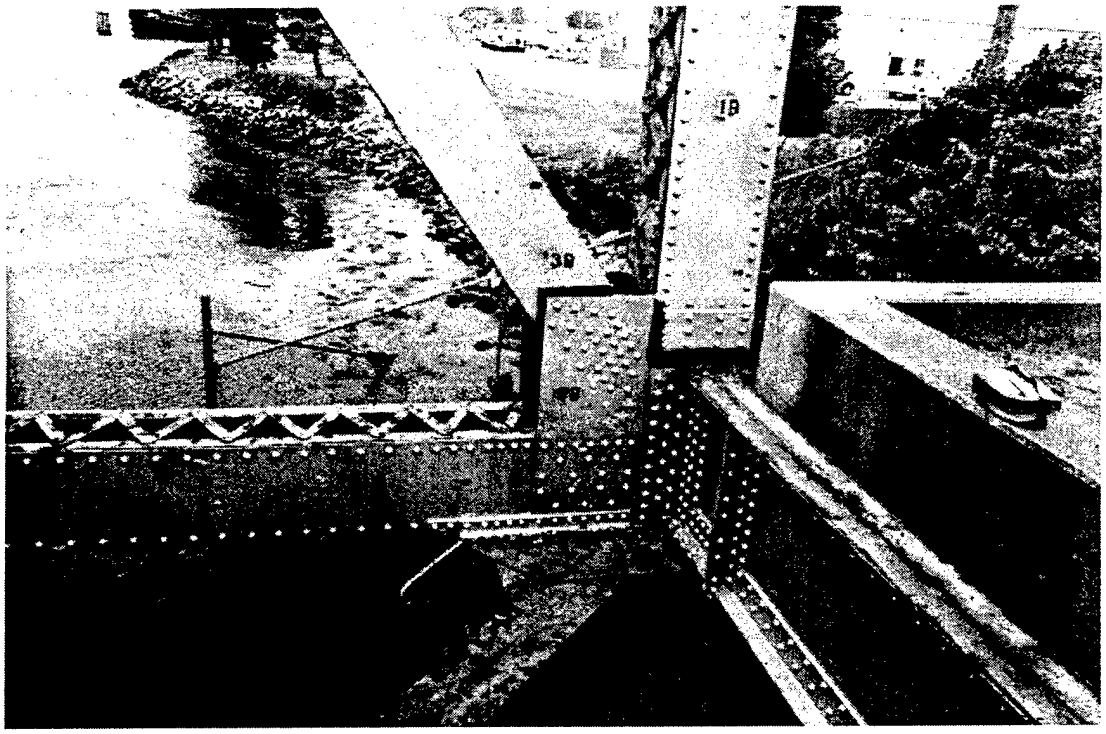


Figure 3. Test sections 1B, 3B, and 6B after 1 year.

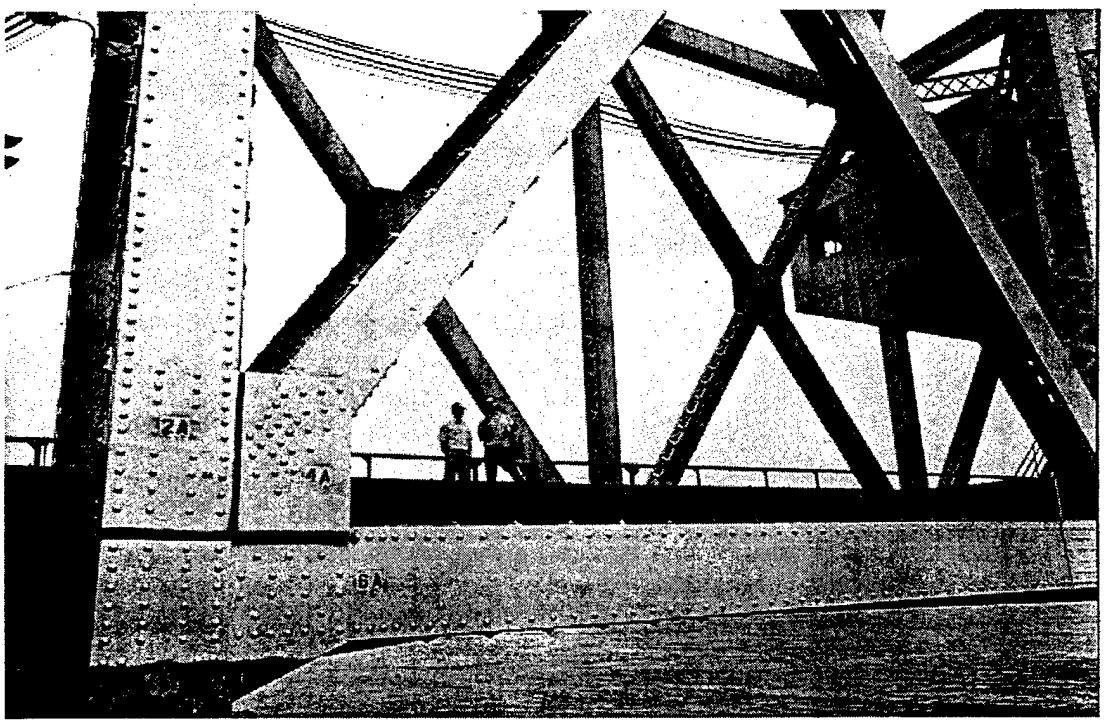


Figure 4. Test sections 2A, 4A, and 6A after 1 year.

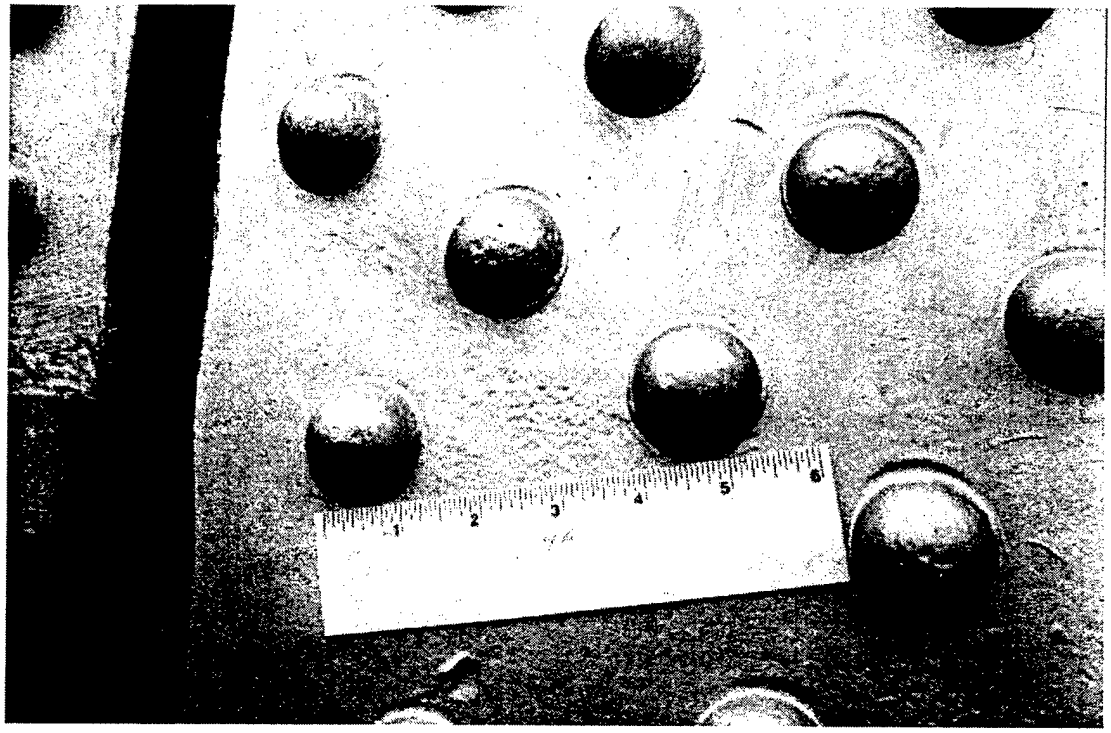


Figure 5. Close-up of section 4A after 1 year.

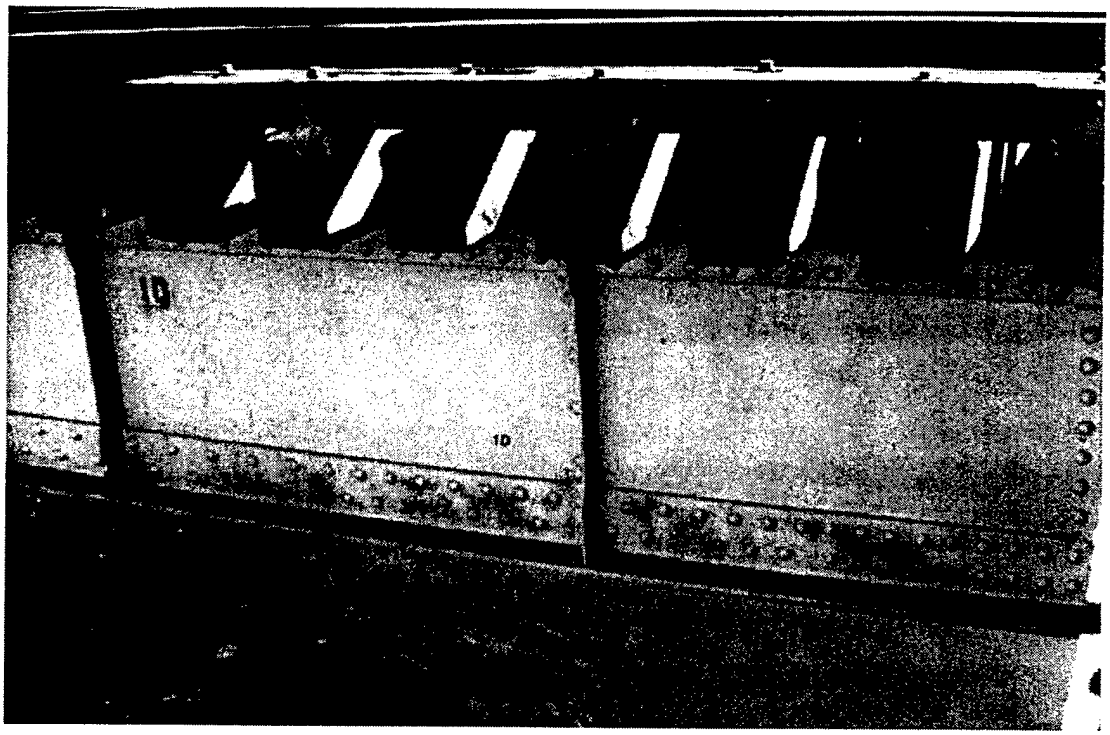


Figure 6. Section 1D after 5 years.

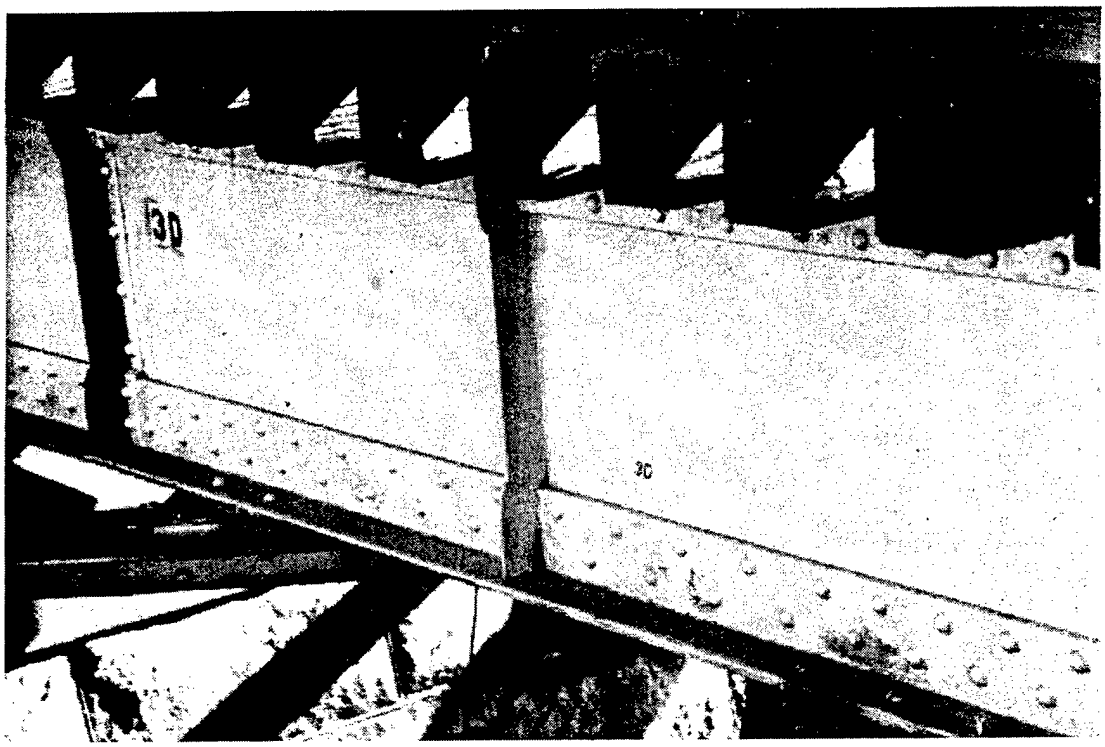


Figure 7. Section 3D after 5 years.

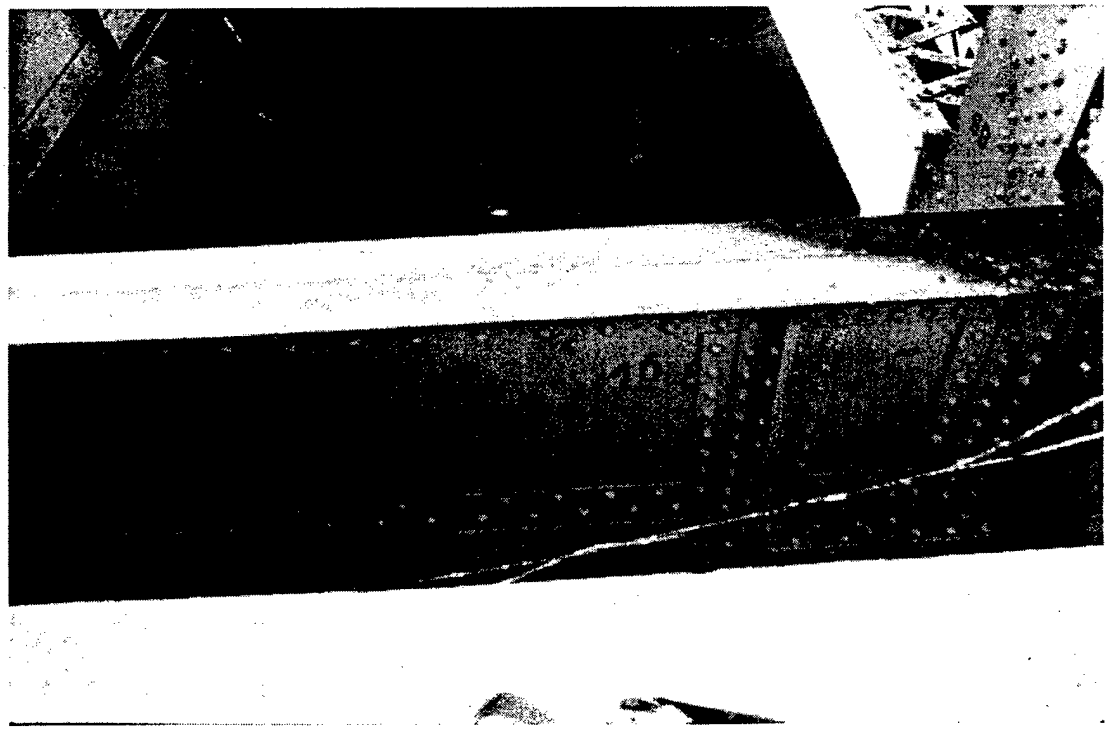


Figure 8. Section 4D after 5 years.

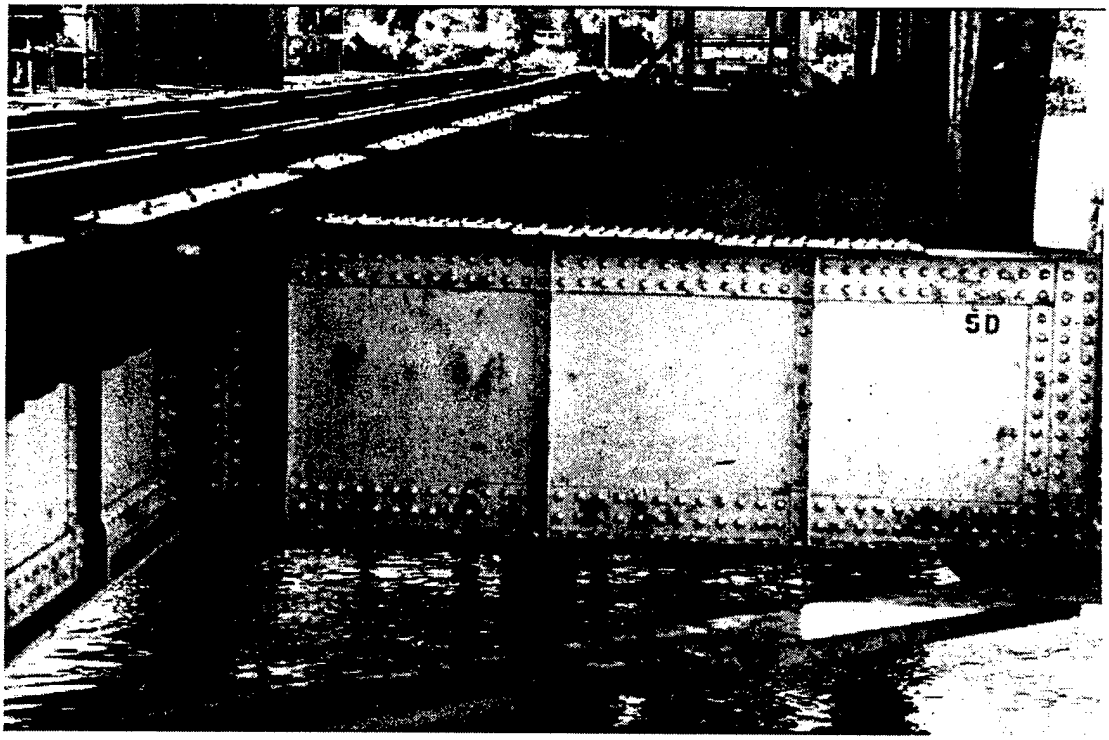


Figure 9. Section 5D after 5 years.

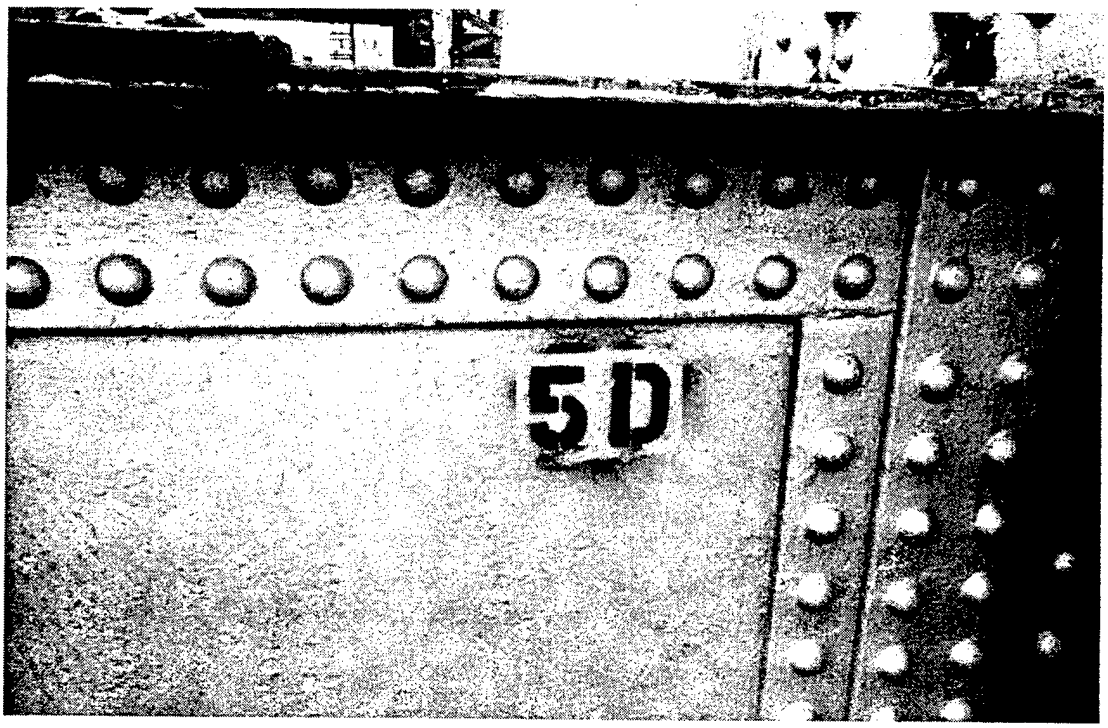


Figure 10. Section 5D close-up.

CERL Distribution

Chief of Engineers
ATTN: CEHEC-IM-LH (2)
ATTN: HECSA Mailroom (2)
ATTN: CECC-R
ATTN: CERD-L
ATTN: CERD-M
ATTN: CECW-EE

Defense Tech Info Center 22304
ATTN: DTIC-O (2)

10
8/99

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	November 1999	Final

4. TITLE AND SUBTITLE
Cape Cod Railroad Bridge Coating Field Test Results

5. FUNDING NUMBERS
REMR
32666

6. AUTHOR(S)
Alfred D. Beitleman

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Construction Engineering Research Laboratory (CERL)
P.O. Box 9005
Champaign, IL 61826-9005

8. PEFORMING ORGANIZATION REPORT NUMBER
SR 99/87

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
HQUSACE
ATTN: CECW-EE
20 Massachusettes Ave. NW
Washington, DC 20314-1000

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

9. SUPPLEMENTARY NOTES
Copies are available from the National Technical Information Service, 5385 Port Royal Road, Springfield, VA 22161

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This report documents observations on the performance of six representative coating systems applied to a steel railroad bridge in 1994 as part of an Army Corps of Engineers field study. The objective of the study was to compare the performance of industry-accepted coating systems as applied to steel surfaces cleaned and prepared according to four different industry standards. The coatings were applied under contract by a local sandblasting and painting company working under typical field conditions.

Two field inspections of the coatings were conducted — once after 1 year of service and again after 5 years of service.

This report provides details on surface preparation, coating application, and field performance, including photographs of the test structure and manufacturers' literature on the six coatings tested.

14. SUBJECT TERMS		15. NUMBER OF PAGES
bridges	coatings	34
civil engineering	railroad	16. PRICE CODE
steel structures		

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ASTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	SAR